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EVALUATION OF A FALSE HEMLOCK LOOPER EPIDEMIC ON THE NATIONAL BISON RANGE, MONTANA DURING MARCH 1964

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INTRODUCTION

An aerial survey for detecting insect and disease damage was made of the National Bison Range, Moiese, Montana, on August 2, 1963. During this flight, three areas (totaling about 375 acres) of defoliated Douglas-fir trees were located (fig. 1). About 75 acres in area A were moderately defoliated (35 to 60 percent of the needles were gone). Area B contained about 100 acres of damaged trees--many were heavily defoliated (55 to 85 percent of the needles were gone). Damage in area C was light (25 to 40 percent of the needles were gone) and covered about 200 acres. These three Douglas-fir stands were on north facing slopes of western ridges. They are isolated from each other by open grasslands.

The infested areas were examined on September 5, 1963. Large numbers of adult moths were in flight around the bases of the trees and in the foliage. The moth was tentatively identified as the false hemlock looper, Nepytia canosaria (Stkr.). A further review of the literature indicated that it might be N. freemani. This is a new species described by Munroe[1/] which belongs in the canosaria group. Its description, location, and type of damage to Douglas-fir are similar to references in Munroe's publication. Specimens have been sent to Munroe for identification.

Nepytia freemani in Canada severely defoliated Douglas-fir in eastern British Columbia during 1948-51. Damage to some trees on the Bison Range indicated that the species of Nepytia involved has the potential of killing trees after 1 or 2 years' feeding.

1/ Munroe, Eugene. A new species of Nepytia (Lepidoptera : Geometridae), of economic importance to Douglas-fir in British Columbia. 1963. Can. Ent. 95:407-413.

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EGG SAMPLING

The overwintering egg population on the foliage was sampled March 26, 1964, to try to predict degree of defoliation this season. Eggs probably hatch in June and the larvae feed until August after going through 5 or 6 instars.

Methods.--The literature contains very little information about the biology or how to sample populations of the false hemlock looper. Some methods and prediction calculations were adopted from Thomson[2/] who sampled western hemlock looper populations.

Ten pole-size Douglas-fir trees were sampled in each area (A, B, and C). Four limbs, one from each side, were cut from each tree at midcrown and about 1 square foot of foliage was removed from each limb. The foliage was placed in plastic bags and brought back to the laboratory for examination. The number of eggs per square foot of foliage was determined.

Results.--The eggs were laid in rows on the underside of needles--occasional clumps were found. Some eggs were laid on the twigs. The number of eggs on a needle varied from 1 to 11. The average number seemed to be five in a row. Eggs were shiny, brownish to grayish-purple, oval in shape with a flattened end, and about 1 mm. in length.

The following tabulation indicates the number of eggs per square foot of foliage in each infested area:

Area	Sq. ft. foliage examined	Viable eggs per one-half sq. ft. foliage	Number of eggs examined			Percentage of nonviable or parasitized eggs
			Viable	Nonviable or parasitized	Total	
A	54	12	1,222	228	1,450	15.7
B	57	39	4,365	745	5,110	14.6
C	48	8	779	75	854	8.8
Totals	159		6,366	1,048	7,414	
Average	53	40				14.1

Thomson[2/] worked with the western hemlock looper which usually lays eggs on lichens and moss found on the bark instead of laying them on needles like the false hemlock looper does. He observed that when 10 or more western

2/ Thomson, M. G. Egg sampling for the western hemlock looper. 1958. For. Chronicle, 34:248-256.

hemlock looper eggs were found per one-half square foot of bark at midcrown, defoliation would be noticeable that season. When the number of eggs increased to 20 or more per one-half square foot, the stands would probably be heavily defoliated. Using Thomson's figures as a guide for predicting false hemlock looper damage, the above data, based on viable eggs per one-half square foot of foliage, seems to indicate that defoliation will be moderate in areas A and C and heavy in area B during 1964 on the Bison Range. Non-viable or parasitized eggs are not abundant enough to reduce the populations to any perceptible extent in the infested areas.

The prediction is that the epidemic will continue and may spread to uninfested stands during 1964, and some sapling-size trees may be killed in areas of heavy defoliation.

DISCUSSION

In a preliminary evaluation report, based on the results of the September 5, 1963 examination, it was mentioned that false hemlock looper larvae could be killed by aerial sprays of DDT. The Bureau of Sport Fisheries and Wildlife does not want DDT applied on the National Bison Range because of the abundant wildlife involved.

If the Bureau decides that control measures are still needed, there are two insecticides of very low mammalian toxicity and residual life that might give adequate kill. They are the organic phosphates called Dylox and Dibrom.

Dylox.--"An outstanding difference between Dylox and other organic phosphate pesticides is in the brief duration of toxic symptoms from sublethal doses. Complete recovery of acutely poisoned rats occurs within a few hours after administration of the compound."3/

The acute oral LD_{50} to rats was 450 to 500 mg./kg. compared to 146 mg./kg. with DDT. The dermal LD_{50} on rabbits was 5,000 mg./kg. which compares to wettable powder formulations of malathion.

A 96-hour TL_m (medium tolerance limit) for bluegills was 3.8 p.p.m. of Dylox, 0.090 p.p.m. of malathion, and 0.016 p.p.m. of DDT.4/

Dylox kills by contact and is soluble in water. It is subject to hydrolysis and probably has a residual life of only 4 days on foliage.

3/ Chemagro Corporation. Technical data sheet about Dylox. 1964. Kansas City, Missouri.

4/ Warren, J. April 7 correspondence. 1964. Chemagro Corporation, Yakima, Washington.

Dibrom.--This material has been used extensively in residential areas and has given good control of 12 types of forest insects and over 32 varieties of crop insects. Residues of Dibrom are such that most crops may be consumed 4 days after application.

The acute oral LD_{50} to rats is 430 mg./kg., and the acute dermal LD_{50} to rats is 1,100 mg./kg.5/ It seems to be three times less toxic to mammals than DDT.

Concentrations of four insecticides in sea water that caused 50 percent mortality to rainbow trout were:5/

DDT, p,p[1]	=	10 micrograms 1 liter
Dibrom	=	80 micrograms 1 liter
Malathion	=	100 micrograms 1 liter
Sevin	=	3,500 micrograms 1 liter

Concentrations (p.p.m.) in feed that caused 50 percent mortality to game birds were:5/

	Bobwhite		Red-winged	Ring-necked pheasants		Mallards
	Young	Adult	blackbirds	Young	Adult	Young
DDT	1,000	2,500	500	1,000	1,000	500
Dibrom	250	1,250	250	5,000		5,000
Malathion	100	250			500	
Sevin	2,500	1,000		5,000	5,000	

Dibrom, then, is more toxic than DDT to bobwhite and blackbirds but less toxic to pheasants and mallards. However, observations regarding the effects of Dibrom on wildlife were obtained after commercial treatment of about 1 million acres for mosquito control. There was no indication of adverse effects to birds, animals, frogs, crabs, etc.

Dibrom is a liquid which is insoluble in water but highly soluble in aromatic solvents. It kills mostly by contact action.

5/ California Chemical Company. Correspondence from research and development department. 1964. Richmond, California.

Considerations.--If the decision is made to spray the false hemlock looper infestation on the National Bison Range, the following responsibilities, plans, and procedures will have to be considered:

The Bureau of Sport Fisheries will probably have to contract a fixed-wing spray plane and supply the necessary men to aid with mixing insecticides, marking areas to be sprayed, collecting foliage samples, and assisting with other jobs. The Division of State and Private Forestry will design the spray project and give technical assistance. The manufacturer of Dylox offered to supply the necessary amount of insecticide free. Dibrom might also be obtained at no cost.

It should be understood that the spray project will be exploratory in nature. Neither Dylox nor Dibrom has been applied from the air to control false hemlock loopers and success will be uncertain. Also, some defoliation will occur before spraying. Laboratory screening tests will be used to determine which of the two materials gives better control of looper larvae and at what dosages. Test larvae from eggs hatched in the laboratory will be reared ahead of the natural population. The following tentative plans are based on Silver's[6/] control project of N. phantasmaria in British Columbia:

1. Determine extent of infestation in areas A, B, and C and mark boundaries with flagging.

2. Select 10 sample trees in each area.

3. Designate area C as the check. After mortality counts have been determined for areas A and B, area C can be sprayed.

4. Make prespray larval counts on foliage samples.

5. Make plans for mixing insecticide and other jobs to be done at landing field.

6. Place spray cards near each sample tree before spraying to determine if tree was hit.

7. Spray when about 75 percent of the larvae are in 3d instar (use head capsule widths to determine this).

8. Collect spray cards on day of spraying.

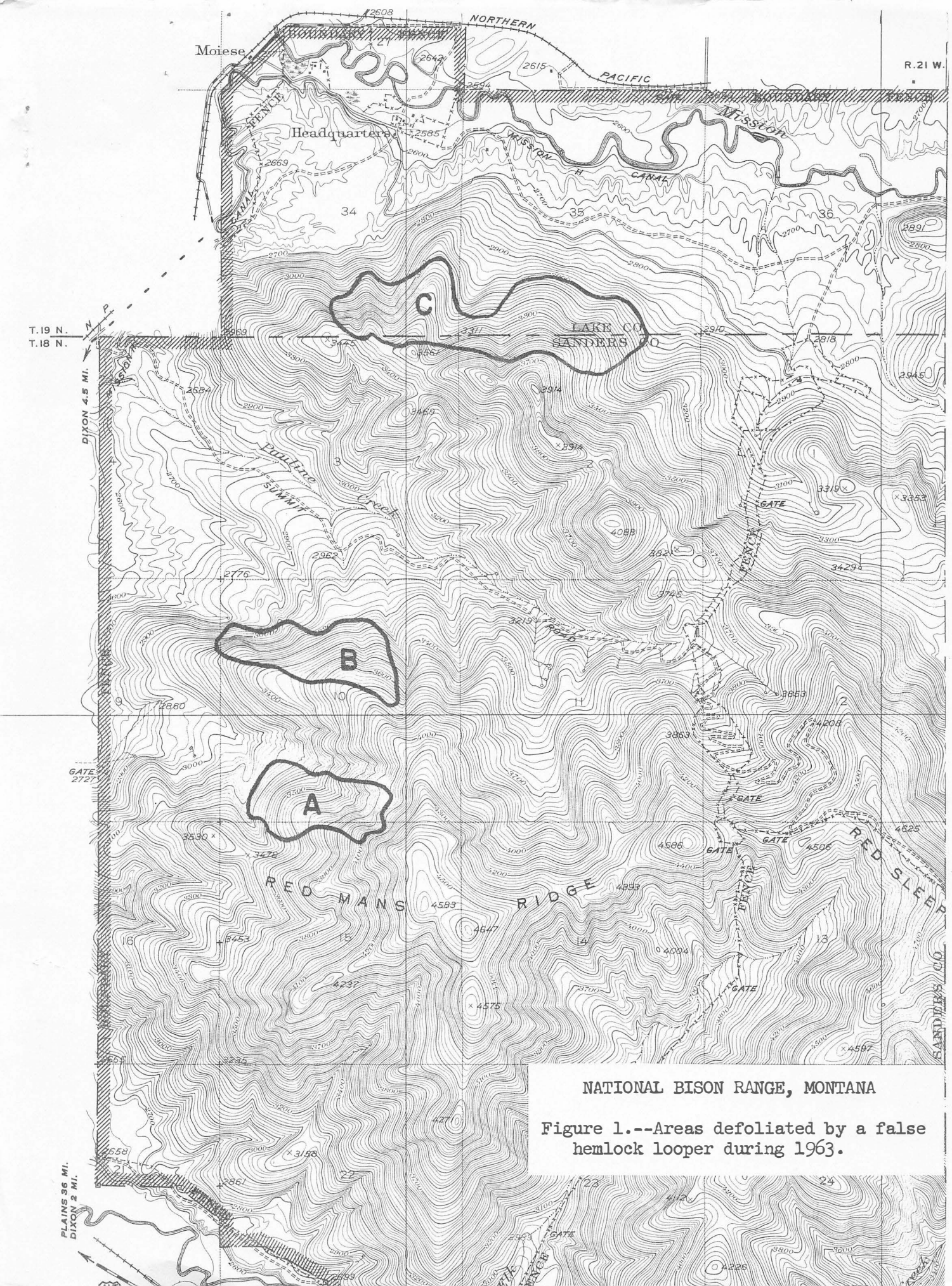
9. Take mortality counts 3 and 7 days after spraying.

10. Treat area C 8 days after spraying areas A and B.

6/ Silver, G. T. Notes on the chemical control of the phantom hemlock looper, Nepytia phantasmaria Stkr. 1958. Unpublished Interim Report 1957-3, Forest Biology Lab., Can. Dept. Ag., Sc. Ser., For. Bio. Div., Victoria, B.C.

Two men from the Division of State and Private Forestry and four men from the Bureau will be needed to accomplish the above jobs.

If Dylox is selected, it will be mixed with water and probably applied at the rate of 1 or 2 pounds per acre. Dibrom would be mixed with fuel oil. For defoliating pests, it is usually applied at ½- to 1-pound per acre.



NATIONAL BISON RANGE, MONTANA

Figure 1.--Areas defoliated by a false hemlock looper during 1963.